PATENT SPECIFICATION

DRAWINGS ATTACHED

934,658

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Inventor: GEOFFREY WILLIAM TROBRIDGE

Date of filing Complete Specification: Feb. 10, 1960.

Application Date: Feb. 26, 1959. *No. 6688/59.*

Complete Specification Published: Aug. 21, 1963.

Index at acceptance:—Classes 108(3), S8M1B; and 52(4), M1B.

International Classification:—F06f. (A47c).

COMPLETE SPECIFICATION

Improvements relating to Inflatable Cushioning Devices

We, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London, N.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to inflatable cushioning devices and is applicable especially to an inflatable cushioning device for use in packaging fragile or delicate goods. It has also, however, applications in other cushioning devices such as seat cushions and mattresses.

When an inflated cushioning device is subjected to compression load its deflection has two distinct phases. In the first phase, under low load, the inflating fluid such as air inside the device is forced from the loaded region to the unloaded regions such as the margins of the device, and the device distends at these unloaded regions without appreciable stretching of its material or compression of the fluid. In the second phase the material of the device is stretched at least at its unloaded regions and the inflating fluid may also be compressed.

This will now be explained in more detail with reference to Figures 1 to 3 of the accompanying drawings, in which:

Figure 1 shows diagrammatically the cushion under zero load,

Figure 2 shows the cushion under a load producing a deflection x and,

Figure 3 is a graph drawn with load as ordinates and deflection as abscissae.

When a conventional inflated cushion 10 formed from two sheets of rubber secured together around their edge is compressed between two plane surfaces 11, 12 (Figure 1), the initial contact between each sheet, which has a rounded profile when inflated, and the respective plane surface is over a small central area only. As the load is increased this area of contact increases and the marginal regions 13 of the cushion become more distended until the stage shown in Figure 2 is reached, at which the parts of the sheets in these regions lie approximately perpendicular to the plane surfaces and the cushion has a substantially rectangular cross-section. This stage marks the end of the first phase and further increase of the load produces, as shown in Figure 3, the second phase of deformation during which the unloaded marginal regions of the cushion, and also possibly parts of it which are in contact with the loading surfaces, are stretched and the inflating air is compressed.

The deflection rate of an inflated cushioning device with increasing load is usually constant in each phase of deflection but the rate in the first phase (indicated by the line OA in Figure 3) is usually considerably lower than that (indicated by the line BC) in the second phase. The rate in the second phase is determined by the elasticity of the material from which it is made and the compressibility of the inflating fluid. For packaging fragile or delicate goods and also for increasing the comfort provided by seat cushions and the like the lower deflection rate of the first phase is the most useful. However, the amount of deflection during this first phase is determined solely by the mechanical construction of the cushioning device and the manner in which the load is applied and in the case of the simple inflated cushion shown in Figures 1 and 2 is quite small and may in fact be insufficient to provide adequate cushioning.

The present invention provides an inflatable cushioning device comprising an assembly of closely adjacent thin walled substantially spherical air-tight chambers formed from flexible material arranged in side by side relation on a common diametral plane and interconnected so that they may be inflated through a single inflation connection in one of them.

The spherical chambers are preferably small compared with the overall area of the device parallel to the diametral plane. It will be appreciated that the diameter of the chambers

limits the thickness of the cushioning device. If devices of greater thickness are required two or more devices as described above may be superimposed.

The advantages derived from a cushioning device according to the invention will now be described with reference to Figures 4 to 6 of the accompanying drawings, in which:

Figure 4 shows diagrammatically the cushioning device under zero load,

Figure 5 shows it under a load producing a deflection y, and

Figure 6 is a load-deflection curve similar to that in Figure 3.

When an assembly of spherical inflated chambers 20 is compressed, as shown in Figures 4 and 5, between parallel load surfaces 11, 12, the first phase of deflection, during which its cross-section is changed from circular (Figure 4) to substantially rectangular (Figure 5) without any appreciable stretching of its material, will take place during a deflection of approximately one third of its original diameter. Thus a cushioning device constructed from spherical chambers in accordance with the invention has a first deflection phase occupying a deflection of approximately one third of its thickness, irrespective of its area which is determined only by the number of spherical chambers. In comparison with this a single chambered cushioning device of the same area, formed from two sheets secured together around their edges and inflated to a maximum thickness equal to the diameter of the spherical chambers of the present device would have a first phase occupying a considerably smaller deflection, approximating to one seventh of its maximum thickness. Furthermore, the device according to the invention has load supporting points spaced throughout substantially its whole area at all stages of deflection whereas the simple cushioning device has load supporting areas only at its central region. A single chambered cushioning device formed initially with a rectangular cross-section when inflated so as to support loads throughout substantially its whole area would of course have only a very small first-phase deflection. The invention thus provides a device having a first phase of soft cushioning characteristic (indicated at OA^1 in Figure 6) throughout a greater deflection than conventional devices of similar dimensions.

A practical form of cushioning device according to the invention will now be described with reference to Figures 7 and 8 of the drawing,

Figure 7 being a plan view of the device with the enclosing bag partly removed, and

Figure 8 being a section on the line A—A in Figure 7.

The cushioning device consists of two sheets of rubber or like flexible material, each of which is formed, e.g. by a vacuum or pressure moulding method, with a plurality of closely adjacent hemispherical cavities. The sheets are secured together at their periphery, e.g. by vulcanisation, to form an assembly of spherical air tight chambers 20 mutually connected by narrow channels 21. One of the spherical chambers 20 is provided with a tubular inflation connection 22, which is conveniently also formed as two semi-cylindrical channels in the original moulding of the sheets.

For protection during use the device is enclosed in a stout but not air-tight stitched canvas bag 23 which is closed at one side by press studs 24 and which carries eyelets 25 for suspending or securing the cushioning device in position for use.

WHAT WE CLAIM IS: —

1. An inflatable cushioning device comprising an assembly of closely adjacent thin walled substantially spherical air-tight chambers formed from flexible material arranged in side-by-side relation on a common diametral plane and inter-connected so that they may be inflated through a single inflation connection in one of them.

2. A device as claimed in claim 1, in which the chambers are made of rubber.

3. A device as claimed in claim 1 or claim 2, in which the assembly is enclosed in a non-airtight bag, e.g. of canvas.

4. A device as claimed in claim 3, in which the bag carries eyelets for suspending or securing the cushioning device in position for use.

5. An inflatable cushioning device, substantially as described herein with reference to Figures 7 and 8 of the accompanying drawings.

C. H. BOWYER,
Agent for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press (Leamington) Ltd.—1963. Published by The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

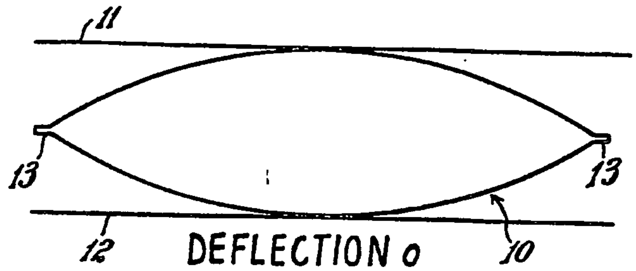


Fig.1

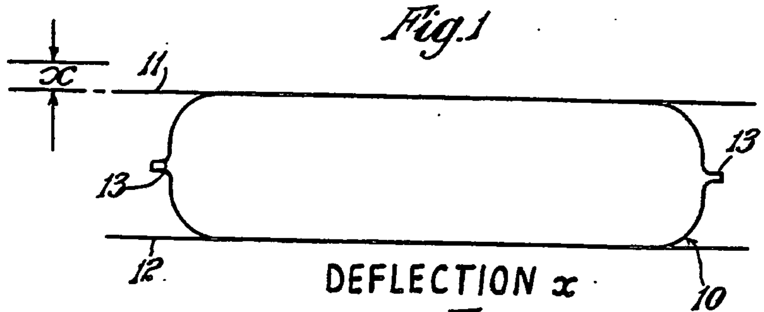


Fig.2

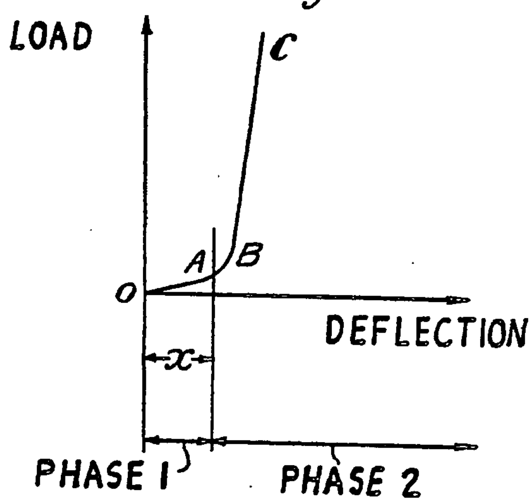


Fig.3

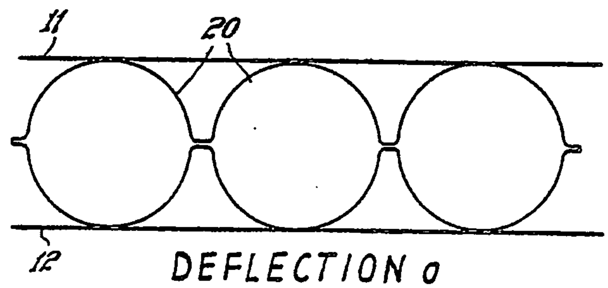


Fig.4

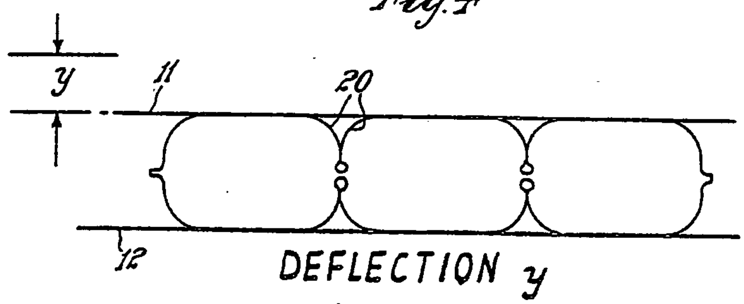


Fig.5

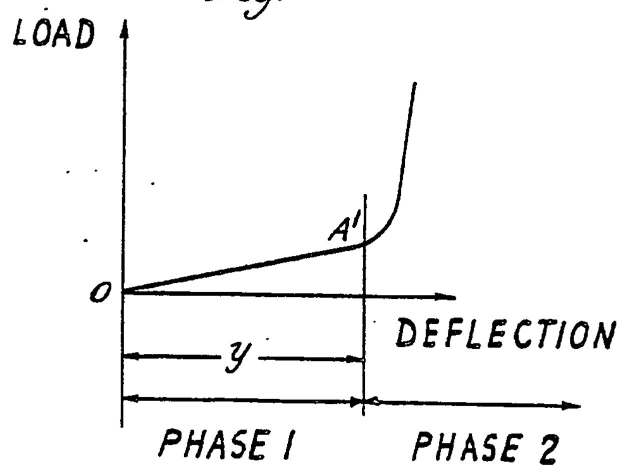


Fig.6

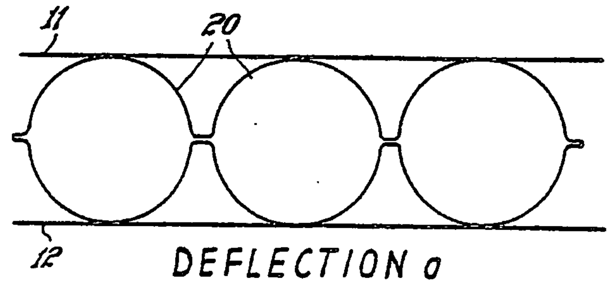


Fig.4

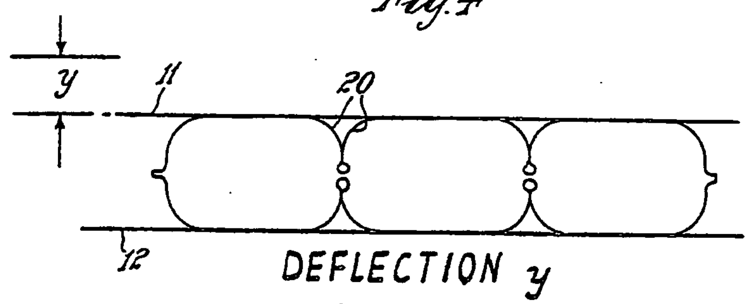


Fig.5

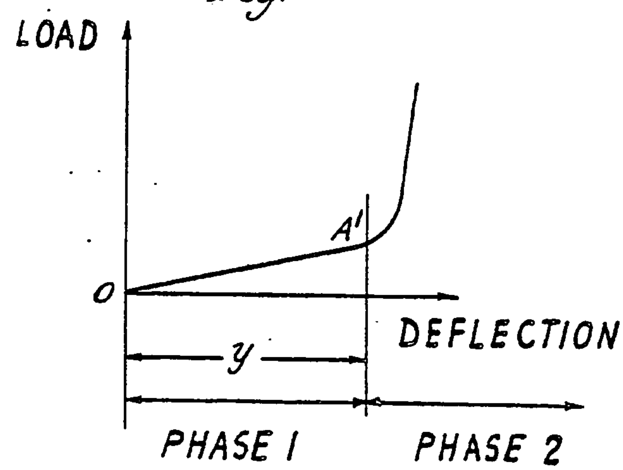
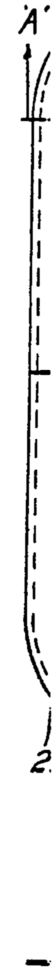


Fig.6



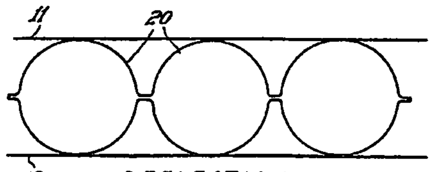


Fig.4

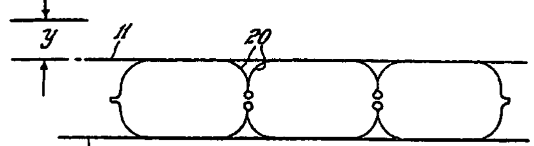


Fig.5

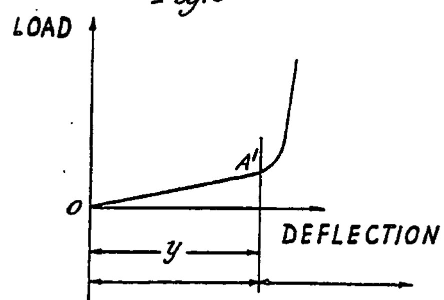


Fig.6

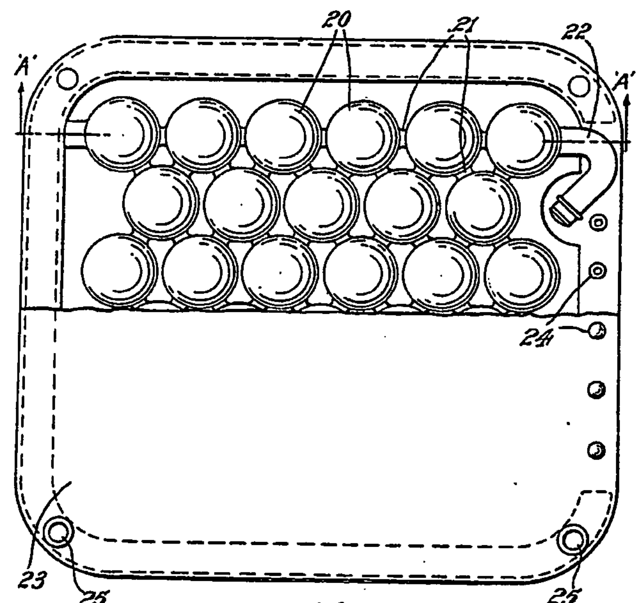


Fig.7

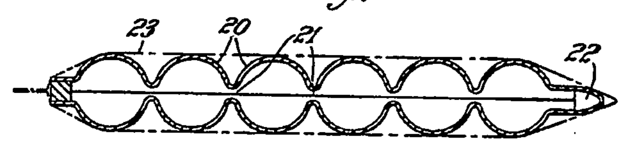


Fig.8